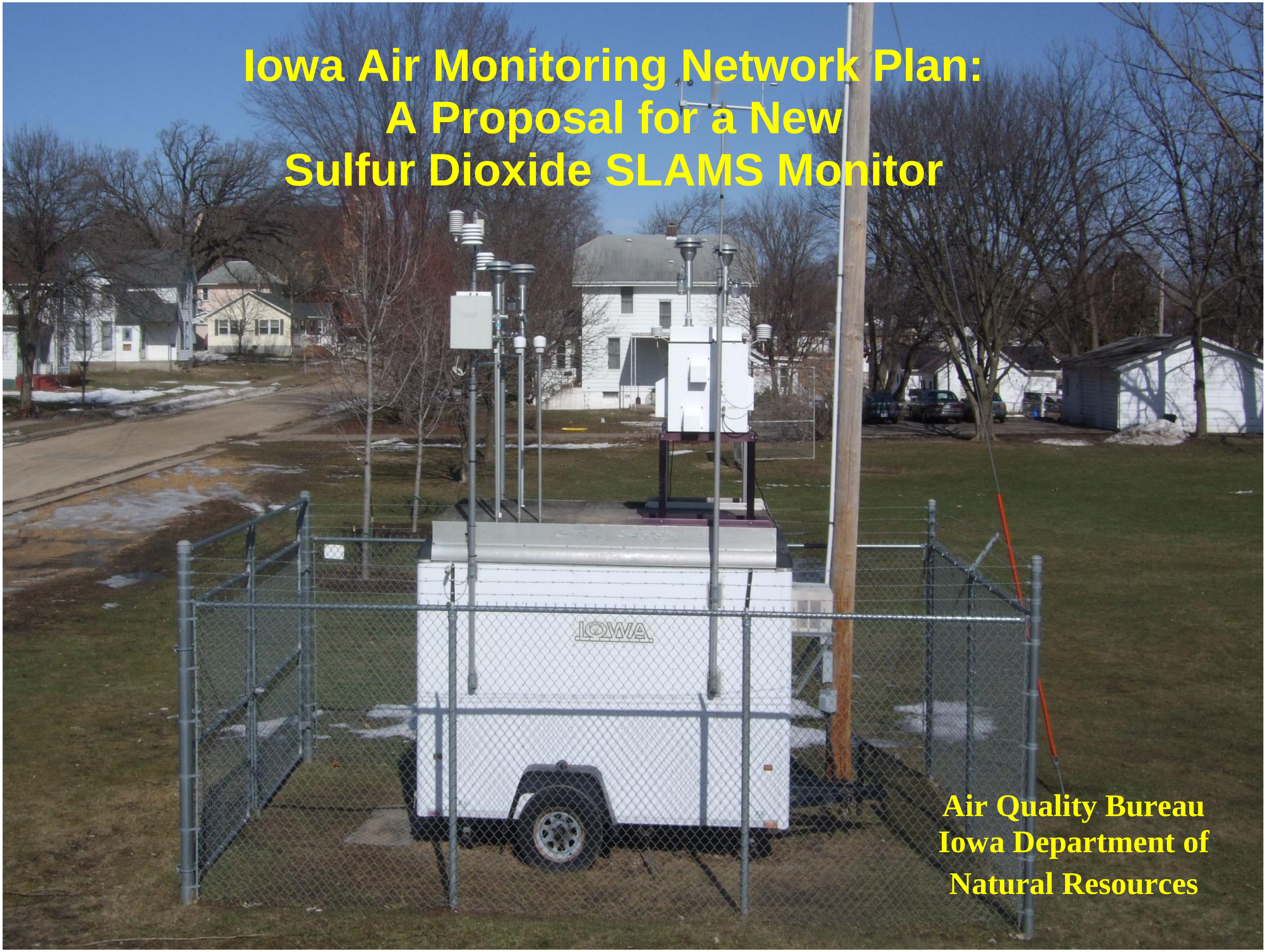
Iowa Air Monitoring Network Plan: A Proposal for a New Sulfur Dioxide SLAMS Monitor



Air Quality Bureau
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Overview

In 2010, the U.S. Environmental Protection Agency revised the sulfur dioxide (SO_2) health standards and the associated monitoring network requirements. This rule requires that a new SO_2 monitoring site be established near Sioux City by January 2013, due to high SO_2 emissions and the large population in the Sioux City area. Most of the SO_2 emissions in this area originate from a power generation facility, George Neal North. Dispersion modeling using current emission rates provided by the facility, predicts multiple areas with concentrations above the SO_2 health standard. The Iowa DNR investigated potential monitoring locations in these areas, and has proposed a site that meets the requirements of the new rule (Appendix A). Federal monitoring rules require that States provide public notice when they intend to add long-term monitoring sites to the State's ambient air monitoring network, and provide a detailed comparison of the sites to the federal requirements. This document is intended to fulfill these two requirements for a new SO_2 monitoring site near Sioux City.

Introduction

States and other agencies delegated to perform air monitoring under the Clean Air Act are required to examine their networks annually to insure that they meet federal requirements (Appendix B). These requirements include the number and type of monitors operated and the frequency of sampling. Certain monitors in the network, known as State and Local Air Monitoring Stations (SLAMS) are required by federal regulations, and modification to the SLAMS monitoring network requires concurrence from EPA (Appendix C). Special Purpose monitors (SPMs) provide important additional air quality information (such as background concentrations for permitting activities) but changes to the SPM network do not require concurrence from EPA.

One of the requirements of the network plan is to provide specific information for monitors that produce data that may be compared with federal air standards. This information, along with information concerning the SO_2 monitors currently operated in the Iowa air monitoring network, is contained in Appendix D and Appendix E.

Sulfur Dioxide Monitoring Network Analysis

EPA modified the SO_2 NAAQS and associated network design criteria on June 2, 2010. The new rule requires operation of monitors in populated areas with high SO_2 emissions by January 1, 2013. Federal requirements for SO_2 monitoring are reproduced in Appendix F. To implement the monitoring requirements of the new rule, EPA developed the population weighted emissions index (PWEI) to determine if SO_2 monitoring is required within an MSA. The PWEI is calculated by multiplying the population of the MSA by the total SO_2 emissions in the MSA and dividing by 1,000,000. The PWEI for Iowa Metropolitan Statistical Areas is computed in Appendix G. Based on this information, the minimum number of SLAMS SO_2 monitors required for MSA's containing at least one Iowa county are indicated below:

MSA	Number of Monitors Required
Omaha-Council Bluffs, NE-IA	1
Sioux City, IA-NE	1

As of January 1, 2012 Iowa operates 8 SO_2 monitors. Two of them are SLAMS monitors. Details concerning existing SO_2 monitoring sites in Iowa can be found in Appendix D and Appendix E. A map of the current Iowa SO_2 monitor network is shown in Appendix H. In 2011, Nebraska operated two SLAMS SO_2 sites in the Omaha-Council Bluffs MSA and South Dakota operated two SLAMS SO_2 monitors in the Sioux City MSA. The location of the current SO_2 monitors for the Council Bluffs and Sioux City MSA's are displayed in Appendix H. Greater than 99% of SO_2 emissions in the Sioux City MSA are from one utility (MidAmerican Energy's George Neal Station) operating in the Iowa portion of the MSA. In order to meet the January 1, 2013, installation deadline of the new monitoring regulations Iowa intends to add a SLAMS SO_2 monitoring site near the MidAmerican George Neal Power Stations located south of Sioux City. Iowa is seeking EPA approval of the proposed SO_2 SLAMS site before submission of the 2012 network plan in order to start site construction during the spring and summer of 2012. Proposed site details are available in Appendix A.

In order to properly site the SO_2 monitor in the area of highest concentration, dispersion modeling was performed using the emissions from the MidAmerican utilities south of Sioux City. The modeling memo with a discussion of the results is presented in Appendix I. In an effort to better understand the effect of the four emission points a supplemental analysis of the modeling data was performed. This analysis was used in conjunction with the modeling memo to properly site the SO_2 monitor in the area of highest ambient SO_2 concentrations and is displayed in Appendix J.

Appendix A: Proposed SO_2 Monitoring Location

Proposed SO_2 Monitoring Location near MidAmerican – George Neal North Facility

The SO_2 NAAQS and network design criteria (Appendix F), modified on June 2, 2010, requires the operation of monitors in populated areas with high SO_2 emissions by January 1, 2013. The population weighted emissions index (PWEI) was used to determine the number of SO_2 monitors required in MSAs containing at least one Iowa county (Appendix G). Based on the PWEI results a SLAMS SO_2 monitor is required in the Omaha-Council Bluffs, NE-IA MSA and the Sioux City, IA-NE-SD MSA.

In 2011, Nebraska operated two SLAMS SO_2 sites in the Omaha-Council Bluffs MSA and South Dakota operated two SLAMS SO_2 monitors in the Sioux City MSA. Since greater than 99% of SO_2 emissions in the Sioux City MSA are generated by one utility (MidAmerican Energy's George Neal Station) operating in the Iowa portion of the MSA, Iowa intends to add a SLAMS SO_2 monitoring site by January 1, 2013, near MidAmerican's George Neal North Generating Station. Dispersion modeling was performed using the facility's emissions and local meteorology to determine areas of high SO_2 concentrations. This modeling (Appendix I) and a supplemental analysis (Appendix J) were used to determine the best location for a SO_2 monitor within the modeled hotspots. The AQS ID for the proposed site is 19-193-0020, and additional site information is available below:

City	Site	Address	County	MSA	Latitude	Longitude	AQS Site ID	Responsible Agency
Sergeant Bluff	George Neal North	2761 Port Neal Circle	Woodbury	Sioux City	42.32767	-96.36807	191930020	SHL

See Appendix D for definitions of the elements in this table.

Site Name	Pollutant	Monitor Type	Sampling Method	Operating Schedule	Primary Monitoring Objective	Spatial Scale	NAAQS Comparable?
Sergeant Bluff, George Neal North	SO2	SLAMS	UV Fluorescent	Continuous	Source Oriented	Middle	Yes

See Appendix E for definitions of the elements in this table.

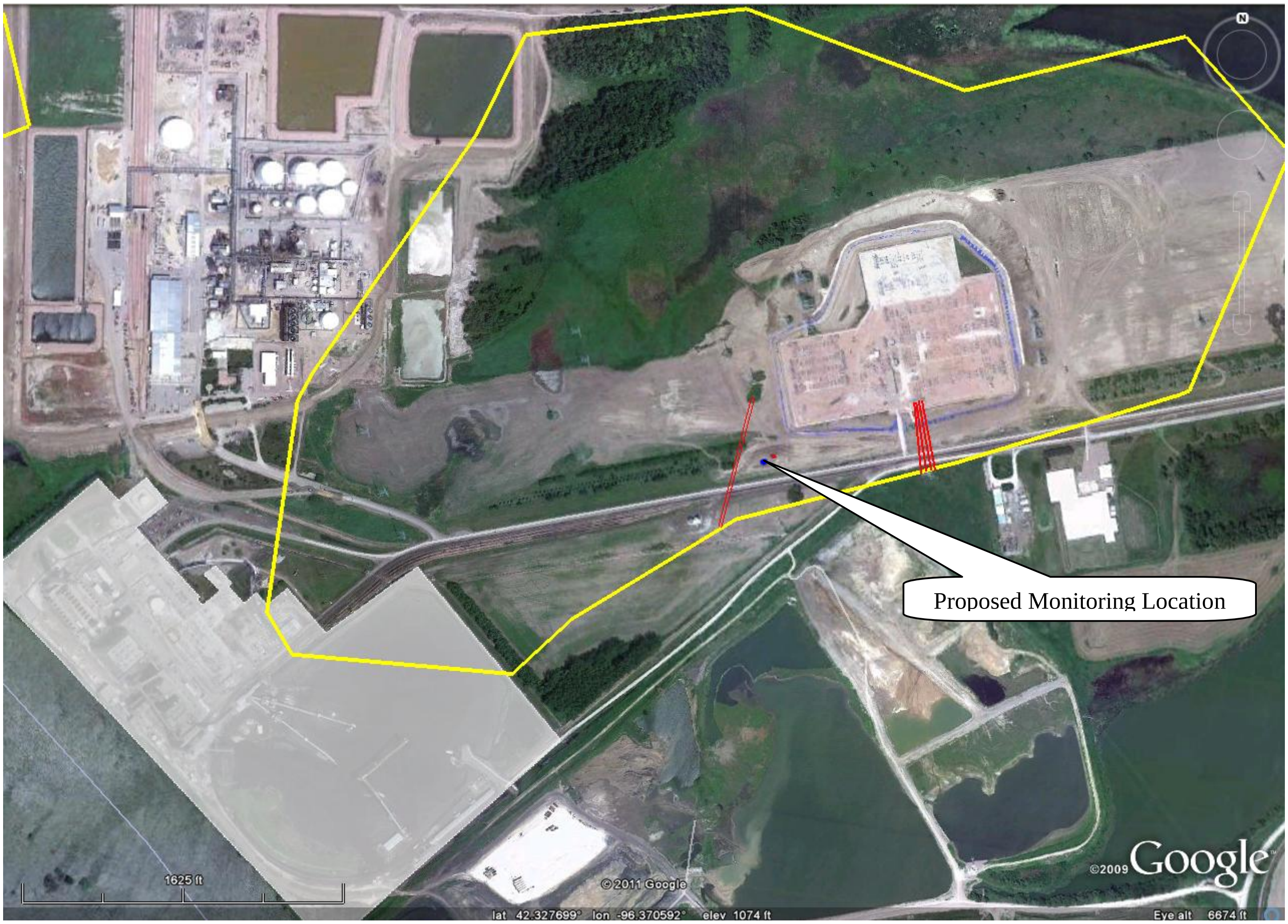


Figure 1. This image, taken from Google Earth, displays the proposed monitoring location (blue square) near the Southwest corner of the George Neal North substation. The red lines represent Hi-Voltage lines crossing the road near the potential site. The yellow polygon represents a modeled NAAQS value. The white polygon represents the MidAmerican George Neal North facility fence line.

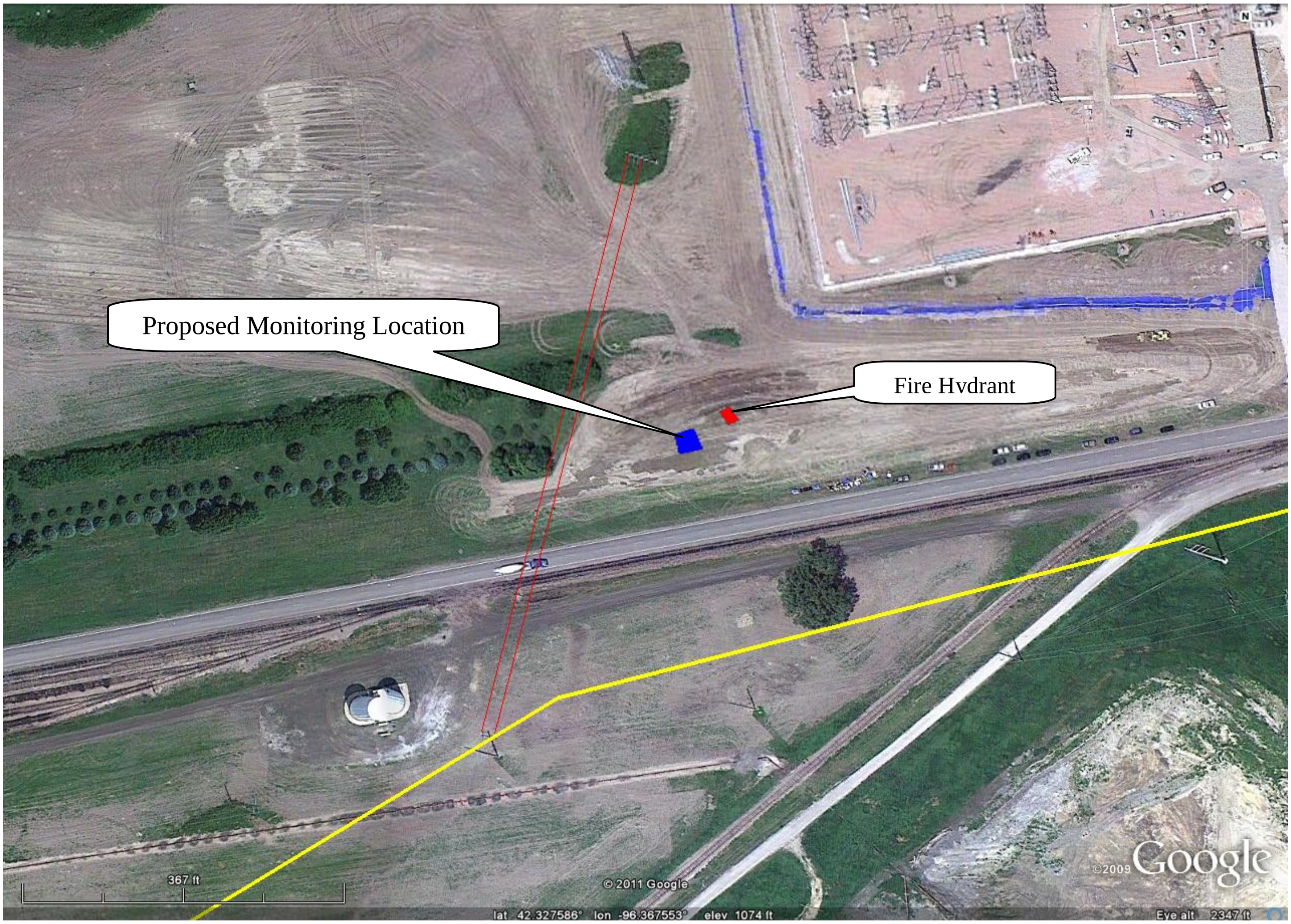


Figure 2. This image is a zoomed in view of Figure 1. The approximate coordinates (using Google Earth) of the proposed monitoring location are 42.327666 °N and -96.368073 °W.

Appendix B: 40 CFR Part 58 Requiring Annual Network Plans

§ 58.10 Annual monitoring network plan and periodic network assessment.

(a)(1) Beginning July 1, 2007, the State, or where applicable local, agency shall adopt and submit to the Regional Administrator an annual monitoring network plan which shall provide for the establishment and maintenance of an air quality surveillance system that consists of a network of SLAMS monitoring stations including FRM, FEM, and ARM monitors that are part of SLAMS, NCore stations, STN stations, State speciation stations, SPM stations, and/or, in serious, severe and extreme ozone nonattainment areas, PAMS stations, and SPM monitoring stations. The plan shall include a statement of purposes for each monitor and evidence that siting and operation of each monitor meets the requirements of appendices A, C, D, and E of this part, where applicable. The annual monitoring network plan must be made available for public inspection for at least 30 days prior to submission to EPA.

(2) Any annual monitoring network plan that proposes SLAMS network modifications including new monitoring sites is subject to the approval of the EPA Regional Administrator, who shall provide opportunity for public comment and shall approve or disapprove the plan and schedule within 120 days. If the State or local agency has already provided a public comment opportunity on its plan and has made no changes subsequent to that comment opportunity, and has submitted the received comments together with the plan, the Regional Administrator is not required to provide a separate opportunity for comment.

(3) The plan for establishing required NCore multipollutant stations shall be submitted to the Administrator not later than July 1, 2009. The plan shall provide for all required stations to be operational by January 1, 2011.

(4) A plan for establishing Pb monitoring sites in accordance with the requirements of appendix D to this part shall be submitted to the EPA Regional Administrator no later than July 1, 2009 as part of the annual network plan required in paragraph (a)(1) of this section. The plan shall provide for the required source-oriented Pb monitoring sites to be operational by January 1, 2010, and for all required non-source-oriented Pb monitoring sites to be operational by January 1, 2011. Specific site locations for the sites to be operational by January 1, 2011 are not required as part of the July 1, 2009 annual network plan, but shall be included in the annual network plan due to be submitted to the EPA Regional Administrator on July 1, 2010.

(5) A plan for establishing NO2 monitoring sites in accordance with the requirements of appendix D to this part shall be submitted to the Administrator by July 1, 2012. The plan shall provide for all required monitoring stations to be operational by January 1, 2013.

(b) The annual monitoring network plan must contain the following information for each existing and proposed site:

(1) The AQS site identification number.

(2) The location, including street address and geographical coordinates.

(3) The sampling and analysis method(s) for each measured parameter.

(4) The operating schedules for each monitor.

(5) Any proposals to remove or move a monitoring station within a period of 18 months following plan submittal.

(6) The monitoring objective and spatial scale of representativeness for each monitor as defined in appendix D to this part.

(7) The identification of any sites that are suitable and sites that are not suitable for comparison against the annual PM2.5 NAAQS as described in § 58.30.

(8) The MSA, CBSA, CSA or other area represented by the monitor.

(9) The designation of any Pb monitors as either source-oriented or nonsource- oriented according to Appendix D to 40 CFR part 58.

(10) Any source-oriented monitors for which a waiver has been requested or granted by the EPA Regional Administrator as allowed for under paragraph 4.5(a)(ii) of Appendix D to 40 CFR part 58.

(11) Any source-oriented or nonsource- oriented site for which a waiver has been requested or granted by the EPA Regional Administrator for the use of Pb-PM10 monitoring in lieu of Pb-TSP monitoring as allowed for under paragraph 2.10 of Appendix C to 40 CFR part 58.

(12) The identification of required NO2 monitors as either near-road or area-wide sites in accordance with appendix D, section 4.3 of this part.

(c) The annual monitoring network plan must document how States and local agencies provide for the review of changes to a PM2.5 monitoring network that impact the location of a violating PM2.5 monitor or the creation/change to a community monitoring zone, including a description of the proposed use of spatial averaging for purposes of making comparisons to the annual PM2.5 NAAQS as set forth in appendix N to part 50 of this chapter. The affected State or local agency must document the process for obtaining public comment and include any comments received through the public notification process within their submitted plan.

(d) The State, or where applicable local, agency shall perform and submit to the EPA Regional Administrator an assessment of the air quality surveillance system every 5 years to determine, at a minimum, if the network meets the monitoring objectives defined in appendix D to this part, whether new sites are needed, whether existing sites are no longer needed and can be terminated, and whether new technologies are appropriate for incorporation into the ambient air monitoring network. The network assessment must consider the ability of existing and proposed sites to support air quality characterization for areas with relatively high populations of susceptible individuals (e.g., children with asthma), and, for any sites that are being proposed for discontinuance, the effect on data users other than the agency itself, such as nearby States and Tribes or health effects studies. For PM2.5, the assessment also must identify needed changes to population-oriented sites. The State, or where applicable local, agency must submit a copy of this 5- year assessment, along with a revised annual network plan, to the Regional Administrator. The first assessment is due July 1, 2010.

(e) All proposed additions and discontinuations of SLAMS monitors in annual monitoring network plans and periodic network assessments are subject to approval according to § 58.14. [71 FR 61298, Oct. 17, 2006, as amended at 72 FR 32210, June 12, 2007; 73 FR 67059, Nov. 12, 2008; 73 FR 77517, Dec. 19, 2008; 75 FR 6534, Feb. 9, 2010]

EFFECTIVE DATE NOTE: At 75 FR 35601, June 22, 2010, § 58.10 was amended by adding paragraph (a)(6), effective Aug. 23, 2010. For the convenience of the user, the added text is set forth as follows:

§ 58.10 Annual monitoring network plan and periodic network assessment.

(a) * * *

(6) A plan for establishing SO2 monitoring sites in accordance with the requirements of appendix D to this part shall be submitted to the EPA Regional Administrator by July 1, 2011 as part of the annual network plan required in paragraph (a) (1). The plan shall provide for all required SO2 monitoring sites to be operational by January 1, 2013.

* * * * *

Appendix C: SLAMS Network Modification

40 CFR Part 58, § 58.14 System modification

(a) The State, or where appropriate local, agency shall develop and implement a plan and schedule to modify the ambient air quality monitoring network that complies with the findings of the network assessments required every 5 years by §58.10(e). The State or local agency shall consult with the EPA Regional Administrator during the development of the schedule to modify the monitoring program, and shall make the plan and schedule available to the public for 30 days prior to submission to the EPA Regional Administrator. The final plan and schedule with respect to the SLAMS network are subject to the approval of the EPA Regional Administrator. Plans containing modifications to NCore Stations or PAMS Stations shall be submitted to the Administrator. The Regional Administrator shall provide opportunity for public comment and shall approve or disapprove submitted plans and schedules within 120 days.

(b) Nothing in this section shall preclude the State, or where appropriate local, agency from making modifications to the SLAMS network for reasons other than those resulting from the periodic network assessments. These modifications must be reviewed and approved by the Regional Administrator. Each monitoring network may make or be required to make changes between the 5-year assessment periods, including for example, site relocations or the addition of PAMS networks in bumped-up ozone nonattainment areas. These modifications must address changes invoked by a new census and changes due to changing air quality levels. The State, or where appropriate local, agency shall provide written communication describing the network changes to the Regional Administrator for review and approval as these changes are identified.

(c) State, or where appropriate, local agency requests for SLAMS monitor station discontinuation, subject to the review of the Regional Administrator, will be approved if any of the following criteria are met and if the requirements of appendix D to this part, if any, continue to be met. Other requests for discontinuation may also be approved on a case-by-case basis if discontinuance does not compromise data collection needed for implementation of a NAAQS and if the requirements of appendix D to this part, if any, continue to be met.

(1) Any $PM_{2.5}$, O_3, CO, PM_{10}, SO_2, Pb, or NO_2SLAMS monitor which has shown attainment during the previous five years, that has a probability of less than 10 percent of exceeding 80 percent of the applicable NAAQS during the next three years based on the levels, trends, and variability observed in the past, and which is not specifically required by an attainment plan or maintenance plan. In a nonattainment or maintenance area, if the most recent attainment or maintenance plan adopted by the State and approved by EPA contains a contingency measure to be triggered by an air quality concentration and the monitor to be discontinued is the only SLAMS monitor operating in the nonattainment or maintenance area, the monitor may not be discontinued.

(2) Any SLAMS monitor for CO, PM_{10}, SO_2, or NO_2which has consistently measured lower concentrations than another monitor for the same pollutant in the same county (or portion of a county within a distinct attainment area, nonattainment area, or maintenance area, as applicable) during the previous five years, and which is not specifically required by an attainment plan or maintenance plan, if control measures scheduled to be implemented or discontinued during the next five years would apply to the areas around both monitors and have similar effects on measured concentrations, such that the retained monitor would remain the higher reading of the two monitors being compared.

(3) For any pollutant, any SLAMS monitor in a county (or portion of a county within a distinct attainment, nonattainment, or maintenance area, as applicable) provided the monitor has not measured violations of the applicable NAAQS in the previous five years, and the approved SIP provides for a specific, reproducible approach to representing the air quality of the affected county in the absence of actual monitoring data.

(4) A $PM_{2.5}$SLAMS monitor which EPA has determined cannot be compared to the relevant NAAQS because of the siting of the monitor, in accordance with §58.30.

(5) A SLAMS monitor that is designed to measure concentrations upwind of an urban area for purposes of characterizing transport into the area and that has not recorded violations of the relevant NAAQS in the previous five years, if discontinuation of the monitor is tied to start-up of another station also characterizing transport.

(6) A SLAMS monitor not eligible for removal under any of the criteria in paragraphs (c)(1) through (c)(5) of this section may be moved to a nearby location with the same scale of representation if logistical problems beyond the State's control make it impossible to continue operation at its current site.

Appendix D: Iowa SO_2 Monitoring Sites

City	Site	Address	County	MSA	Latitude	Longitude	AQS Site ID	Responsible Agency
Cedar Rapids	Scottish Rite Temple	616 A Ave.	Linn	CDR	41.98333	-91.66278	191130031	Linn Local Prog.
	Public Health	500 11th St. NW	Linn	CDR	41.97677	-91.68766	191130040	Linn Local Prog.
Clinton	Chancy Park	23rd & Camanche	Clinton	-	41.82328	-90.21198	190450019	DNR
Davenport	Jefferson School	10th St. & Vine St.	Scott	DMR	41.53001	-90.58761	191630015	DNR
Des Moines	Health Dept.	1907 Carpenter	Polk	DSM	41.60318	-93.64330	191530030	Polk Local Prog.
Muscatine	Greenwood Cemetary	Fletcher St. & Kimble St.	Muscatine	-	41.41943	-91.07098	191390016	DNR
	Musser Park	Oregon St. & Earl Ave.	Muscatine	-	41.40780	-91.06265	191390020	DNR
-	Lake Sugema	24430 Lacey Trl, Keosauqua	Van Buren	-	40.69508	-92.00632	191770006	DNR

Site Table Definitions:

City – the city closest to the monitor location.

Site – the name of the monitoring site.

Address – an intersection or street address close to the monitoring site.

County – the county where the monitoring site resides.

MSA – Metropolitan Statistical Area. Iowa's Metropolitan Statistical Areas (MSA's) according to July, 2009 U.S. Census Bureau estimates:

U.S. Census Geographic area	Abbreviation
Omaha-Council Bluffs, NE-IA	OMC
Des Moines-West Des Moines, IA	DSM
Davenport-Moline-Rock Island, IA-IL	DMR
Cedar Rapids, IA	CDR
Waterloo-Cedar Falls, IA	WTL
Sioux City, IA-NE-SD	SXC
Iowa City, IA	IAC
Dubuque, IA	-
Ames, IA	-

From: http://www.census.gov/popest/data/metro/totals/2009/index.html *Annual Estimates of the Population of Metropolitan and Micropolitan Statistical Areas: April 1, 2000 to July 1, 2009 (CBSA-EST2009-01). Source: Population Division, U.S. Census Bureau, Release Date: March 2010*

Maximum ozone concentrations are typically measured 10-30 miles downwind of an MSA. The site intended to record the maximum ozone concentration resulting from a given MSA may be located outside the MSA boundaries. Sites intended to measure background levels of pollutants for an MSA may also be located upwind and outside of that particular MSA.

Latitude – the latitude of a monitoring site**,** given in decimal degrees using the WGS (World Geodetic System) 84 datum.

Longitude – the longitude of a monitoring site, given in decimal degrees using the WGS (World Geodetic System) 84 datum.

AQS Site ID – The identifier of a monitoring site used in the US EPA Air Quality System (AQS) database. It has the form XX-XXX-XXXX where the first two digits specify the state (19 for Iowa), the next set of three digits the county, and the last four digits the site.

Responsible Agency – The agency responsible for performing ambient air monitoring at a monitoring site. The Polk County Local Program operates sites in or near Polk County. The Linn County Local Program operates sites in or near Linn County. The Department of Natural Resources (DNR) contracts with the State Hygienic Laboratory at the University of Iowa (SHL) to operate monitoring sites not operated by the Polk or Linn County Local Programs.

Appendix E: Iowa SO_2 Monitors

Site Name	Pollutants Measured	Monitor Type	Sampling Method	Operating Schedule	Primary Monitoring Objective	Spatial Scale	NAAQS Comparable?
Cedar Rapids, Public Health	SO2	SPM	UV Fluorescent	Continuous	Population Exposure	Neighborhood	Yes
Cedar Rapids, Scottish Rite Temple	SO2	SPM	UV Fluorescent	Continuous	Source Oriented	Middle	Yes
Clinton, Chancy Park	SO2	SPM	UV Fluorescent	Continuous	Source Oriented	Middle	Yes
Davenport, Jefferson Sch.	SO2	Proposed NCORE	UV Fluorescent	Continuous	Population Exposure	Urban	Yes
Des Moines, Health Dept.	SO2	SPM	UV Fluorescent	Continuous	Population Exposure	Urban	Yes
Keosauqua, Lake Sugema	SO2	SPM	UV Fluorescent	Continuous	General/Background	Regional	Yes
Muscatine, Greenwood Cemetary	SO2	SPM	UV Fluorescent	Continuous	General/Background	Middle	Yes
Muscatine, Musser Park	SO2	SLAMS	UV Fluorescent	Continuous	Source Oriented	Middle	Yes

Monitor Table Definitions:

Site Name – a combination of the city and site name from the previous table

Pollutants Measured – indicates the pollutant, or set of pollutants, measured by each monitor

- SO_2 – sulfur dioxide

Monitor Type – This column indicates how the monitor is classified in the AQS database.

- IMPROVE – a speciation monitor developed by the IMPROVE program to identify and quantify the chemical components of $PM_{2.5}$.
- Proposed NCore – monitors operated at a site which has been proposed for inclusion in EPA's national network of long term multi-pollutant sites (NCore).
- SLAMS – State and Local Air Monitoring Stations. SLAMS make up the ambient air quality monitoring sites that are primarily needed for NAAQS comparisons, but may serve other data purposes. SLAMS exclude special purpose monitor (SPM) stations and include NCore, and all other State or locally operated stations that have not been designated as SPM stations.
- SPM – means a monitor that is designated as a special purpose monitor in the monitoring network plan and in EPA's AQS database. SPM monitors do not count when showing compliance with minimum SLAMS requirements for monitor numbers and siting.
- Supplemental Speciation – a speciation site with monitors that are operated according to CSN protocols, but not contained in the STN Network.

Sampling Method – Indicates how the sample is collected. This column also shows how the sample is analyzed, if it is analyzed on site at the time of collection.

- UV Fluorescent – When excited by ultraviolet light, SO_2 molecules emit light at a lower frequency that may be detected by a photomultiplier tube. This property is the basis for the analytical method used for both continuous SO_2 gas analyzers, as well as continuous particulate sulfate monitors. In the latter case, sulfate particles are first converted to SO_2 gas.

Operating Schedule – Continuous monitors run constantly and measure hourly average concentrations in real time. Manual samplers, such as PM filter samplers or toxics samplers, collect a single 24 hour sample from midnight to midnight on a particular day, which is quantified later in an analytical laboratory.

Monitoring Objective – the primary reason a monitor is operated at a particular location.

- General Background – The objective is to establish the background levels of a pollutant.
- Highest Conc. – The objective is to measure at a site where the concentration of the pollutant is highest.
- Max. Ozone Conc. – The objective is to record the maximum ozone concentration. Because ozone is a secondary pollutant, ozone concentrations are typically highest 10-30 miles downwind of an urban area.
- Population Exposure – The objective is to monitor the exposure of individuals in the area represented by the monitor.
- Regional Transport – The objective is to assess the extent to which pollutants are transported between two regions that are separated by tens to hundreds of kilometers.
- Source Oriented – The objective is to determine the impact of a nearby source.
- Transport – The objective is to assess the extent to which pollutants are transported from one location to another.

- Upwind Background – The objective is to establish the background levels of a pollutant, typically upwind of a source or urban area.

Spatial Scale – The scale of representativeness is described in terms of the physical dimensions of the air parcel nearest to a monitoring site throughout which actual pollutant concentrations are reasonably similar. Monitors are classified according to the largest applicable scale below:

- Microscale - defines the concentrations in air volumes associated with area dimensions ranging from several meters up to about 100 meters.
- Middle scale - defines the concentration typical of areas up to several city blocks in size with dimensions ranging from about 100 meters to 0.5 kilometer.
- Neighborhood scale - defines concentrations within some extended area of the city that has relatively uniform land use with dimensions in the 0.5 to 4.0 kilometers range. The neighborhood and urban scales listed below have the potential to overlap in applications that concern secondarily formed or homogeneously distributed air pollutants.
- Urban scale - defines concentrations within an area of city-like dimensions, on the order of 4 to 50 kilometers. Within a city, the geographic placement of sources may result in there being no single site that can be said to represent air quality on an urban scale.
- Regional scale – usually defines a rural area of reasonably homogeneous geography without large sources, and extends from tens to hundreds of kilometers.

NAAQS Comparable? - This column shows whether the data from the monitor can be compared to the National Ambient Air Quality Standards (NAAQS). Entries under this column are Yes, No, and 24 Hour Only. For a monitor’s data to be eligible for comparison against the NAAQS, the type of monitor used must be defined as a federal reference method or federal equivalent method by EPA.

Appendix F: Federal Requirements for SO_2 Sites

40 CFR Part 58 Appendix D —Network Design Criteria for Ambient Air Quality Monitoring

4.4 Sulfur Dioxide (SO2) Design Criteria.

4.4.1 *General Requirements.* (a) State and, where appropriate, local agencies must operate a minimum number of required SO2 monitoring sites as described below.

4.4.2 *Requirement for Monitoring by the Population Weighted Emissions Index.* (a) The population weighted emissions index (PWEI) shall be calculated by States for each core based statistical area (CBSA) they contain or share with another State or States for use in the implementation of or adjustment to the SO2 monitoring network. The PWEI shall be calculated by multiplying the population of each CBSA, using the most current census data or estimates, and the total amount of SO2 in tons per year emitted within the CBSA area, using an aggregate of the most recent county level emissions data available in the National Emissions Inventory for each county in each CBSA. The resulting product shall be divided by one million, providing a PWEI value, the units of which are million persons-tons per year. For any CBSA with a calculated PWEI value equal to or greater than 1,000,000, a minimum of three SO2 monitors are required within that CBSA. For any CBSA with a calculated PWEI value equal to or greater than 100,000, but less than 1,000,000, a minimum of two SO2 monitors are required within that CBSA. For any CBSA with a calculated PWEI value equal to or greater than 5,000, but less than 100,000, a minimum of one SO2 monitor is required within that CBSA.

(1) The SO2 monitoring site(s) required as a result of the calculated PWEI in each CBSA shall satisfy minimum monitoring requirements if the monitor is sited within the boundaries of the parent CBSA and is one of the following site types (as defined in section 1.1.1 of this appendix): population exposure, highest concentration, source impacts, general background, or regional transport. SO2 monitors at NCore stations may satisfy minimum monitoring requirements if that monitor is located within a CBSA with minimally required monitors under this part. Any monitor that is sited outside of a CBSA with minimum monitoring requirements to assess the highest concentration resulting from the impact of significant sources or source categories existing within that CBSA shall be allowed to count towards minimum monitoring requirements for that CBSA.

4.4.3 *Regional Administrator Required Monitoring.* (a) The Regional Administrator may require additional SO2 monitoring stations above the minimum number of monitors required in 4.4.2 of this part, where the minimum monitoring requirements are not sufficient to meet monitoring objectives. The Regional Administrator may require, at his/her discretion, additional monitors in situations where an area has the potential to have concentrations that may violate or contribute to the violation of the NAAQS, in areas impacted by sources which are not conducive to modeling, or in locations with susceptible and vulnerable populations, which are not monitored under the minimum monitoring provisions described above. The Regional Administrator and the responsible State or local air monitoring agency shall work together to design and/or maintain the most appropriate SO2 network to provide sufficient data to meet monitoring objectives.

4.4.4 SO2 *Monitoring Spatial Scales.* (a) The appropriate spatial scales for SO2 SLAMS monitors are the microscale, middle, neighborhood, and urban scales. Monitors sited at the microscale, middle, and neighborhood scales are suitable for determining maximum hourly concentrations for SO2. Monitors sited at urban scales are useful for identifying SO2 transport, trends, and, if sited upwind of local sources, background concentrations.

(1) *Microscale*—This scale would typify areas in close proximity to SO2 point and area sources. Emissions from stationary point and area sources, and non-road sources may, under certain plume conditions, result in high ground level concentrations at the microscale. The microscale typically represents an area impacted by the plume with dimensions extending up to approximately 100 meters.

(2) *Middle scale*—This scale generally represents air quality levels in areas up to several city blocks in size with dimensions on the order of approximately 100 meters to 500 meters. The middle scale may include locations of expected maximum short-term concentrations due to proximity to major SO2 point, area, and/or non-road sources.

(3) *Neighborhood scale*—The neighborhood scale would characterize air quality conditions throughout some relatively uniform land use areas with dimensions in the 0.5 to 4.0 kilometer range. Emissions from stationary point and area sources may, under certain plume conditions, result in high SO2 concentrations at the neighborhood scale. Where a neighborhood site is located away from immediate SO2 sources, the site may be useful in representing typical air quality values for a larger residential area, and therefore suitable for population exposure and trends analyses.

(4) *Urban scale*—Measurements in this scale would be used to estimate concentrations over large portions of an urban area with dimensions from 4 to 50 kilometers. Such measurements would be useful for assessing trends in area-wide air quality, and hence, the effectiveness of large scale air pollution control strategies. Urban scale sites may also support other monitoring objectives of the SO2 monitoring network such as identifying trends, and when monitors are sited upwind of local sources, background concentrations.

4.4.5 *NCore Monitoring.* (a) SO2 measurements are included within the NCore multipollutant site requirements as described in paragraph (3)(b) of this appendix. NCore based SO2 measurements are primarily used to characterize SO2 trends and assist in understanding SO2 transport across representative areas in urban or rural locations and are also used for comparison with the SO2 NAAQS. SO2 monitors at NCore sites that exist in CBSAs with minimum monitoring requirements per section 4.4.2 above shall be allowed to count towards those minimum monitoring requirements.* * * * *

Appendix G: Sulfur Dioxide Population Weighted Emissions Index

The new SO_2 rule requires monitoring in or near Core Based Statistical Areas (CBSA's) based on the population weighted emissions index (PWEI). The PWEI is calculated using the most recent census data or estimates, and the most recent county level emissions data available in the National Emissions Inventory.

The PWEI is calculated by multiplying the population of the CBSA by the total tons of SO_2 emissions inventories from counties that make up the CBSA and dividing by one million. The PWEI is expressed in units of million person-tons per year.

The final monitoring regulations require monitors to be placed in Core Based Statistical Areas (CBSA's) based on the PWEI for the area. The final rule requires:

- 3 monitors in CBSAs with index values of 1,000,000 or more;
- 2 monitors in CBSAs with index values less than 1,000,000 but greater than 100,000; and
- 1 monitor in CBSAs with index values greater than 5,000.

Iowa has chosen to use the 2008 National Emissions Inventory (NEI) data[1] as the most complete and accessible data to use for SO_2 emissions information. 2010 U.S. Census Bureau population estimates[2] have been used for population data. The PWEI for Iowa MSA's are listed in the table below.

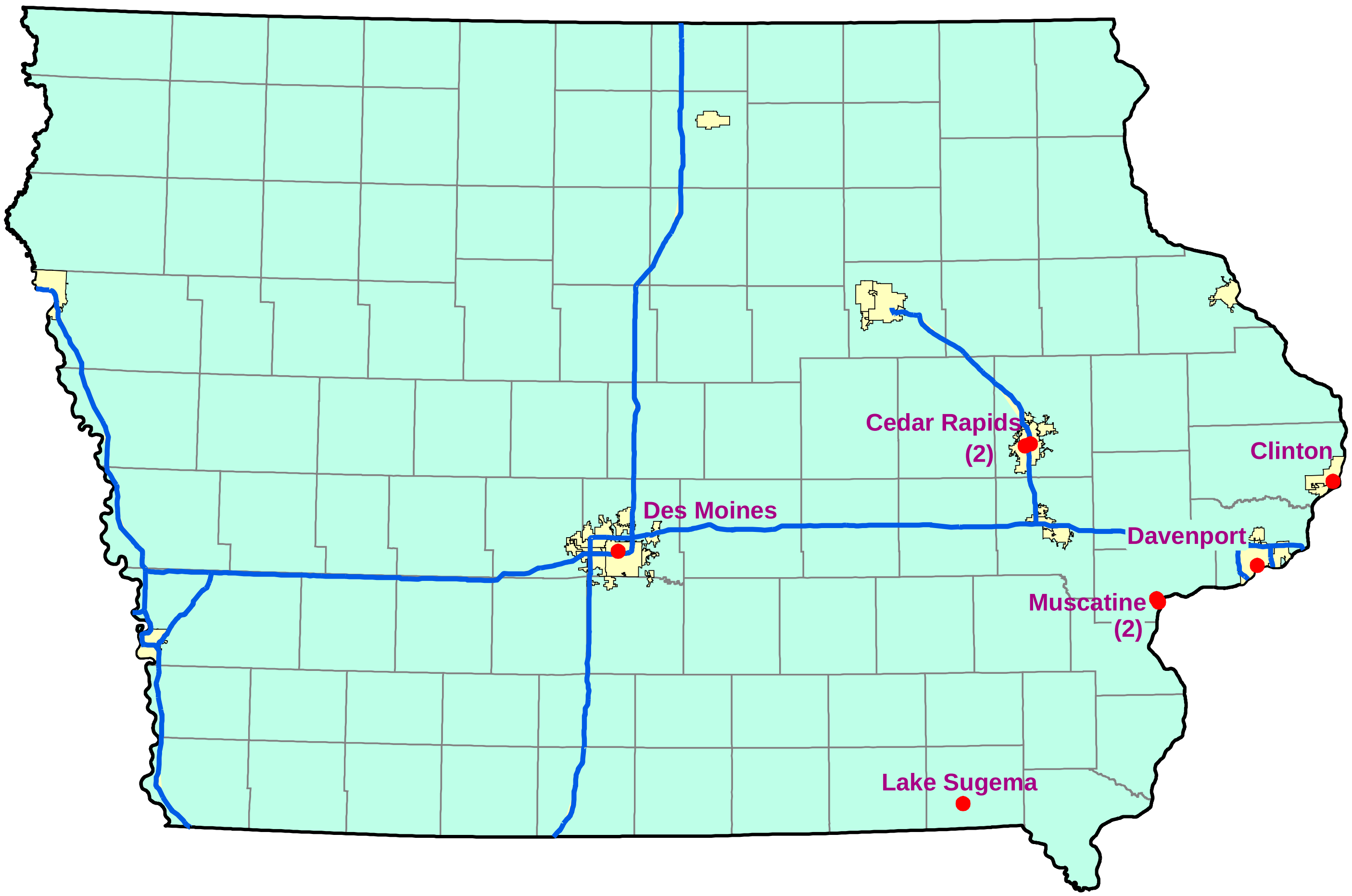
US Census Geographic Area	US Census Population Estimate, 2010	SO_2 Emissions, tons per year (2008 NEI)	SO_2 Population Weighted Emissions Index
Omaha-Council Bluffs, NE-IA	865,350	59,630	51,601
Sioux City, IA-NE	143,577	35,637	5,117
Davenport-Moline-Rock Island, IA-IL	379,690	7,337	2,786
Cedar Rapids, IA	257,940	8,094	2,088
Des Moines-West Des Moines, IA	569,633	676	385
Ames, IA	89,542	4,296	385
Iowa City, IA	152,586	1,098	167
Waterloo-Cedar Falls, IA	167,819	551	92
Dubuque, IA	93,653	12	1

[1] http://www.epa.gov/ttnchie1/net/2008inventory.html

[2] http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_NSRD_GCTPL2.US24PR&prodType=table

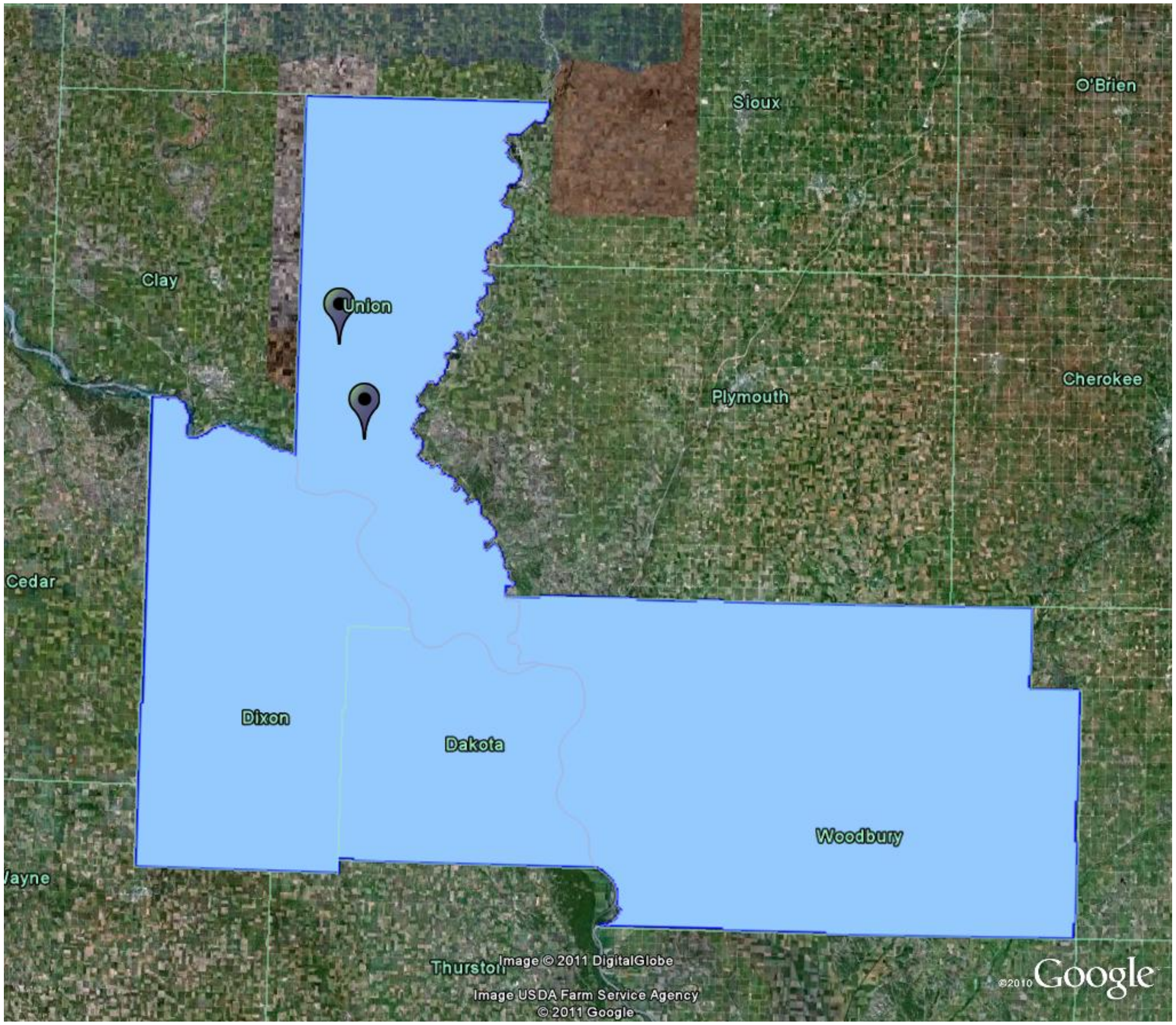
Appendix H: Maps of SO_2 Monitoring Locations

The following map shows the locations of the current SO_2 monitoring sites in the state of Iowa, which are current as of January 1, 2012.



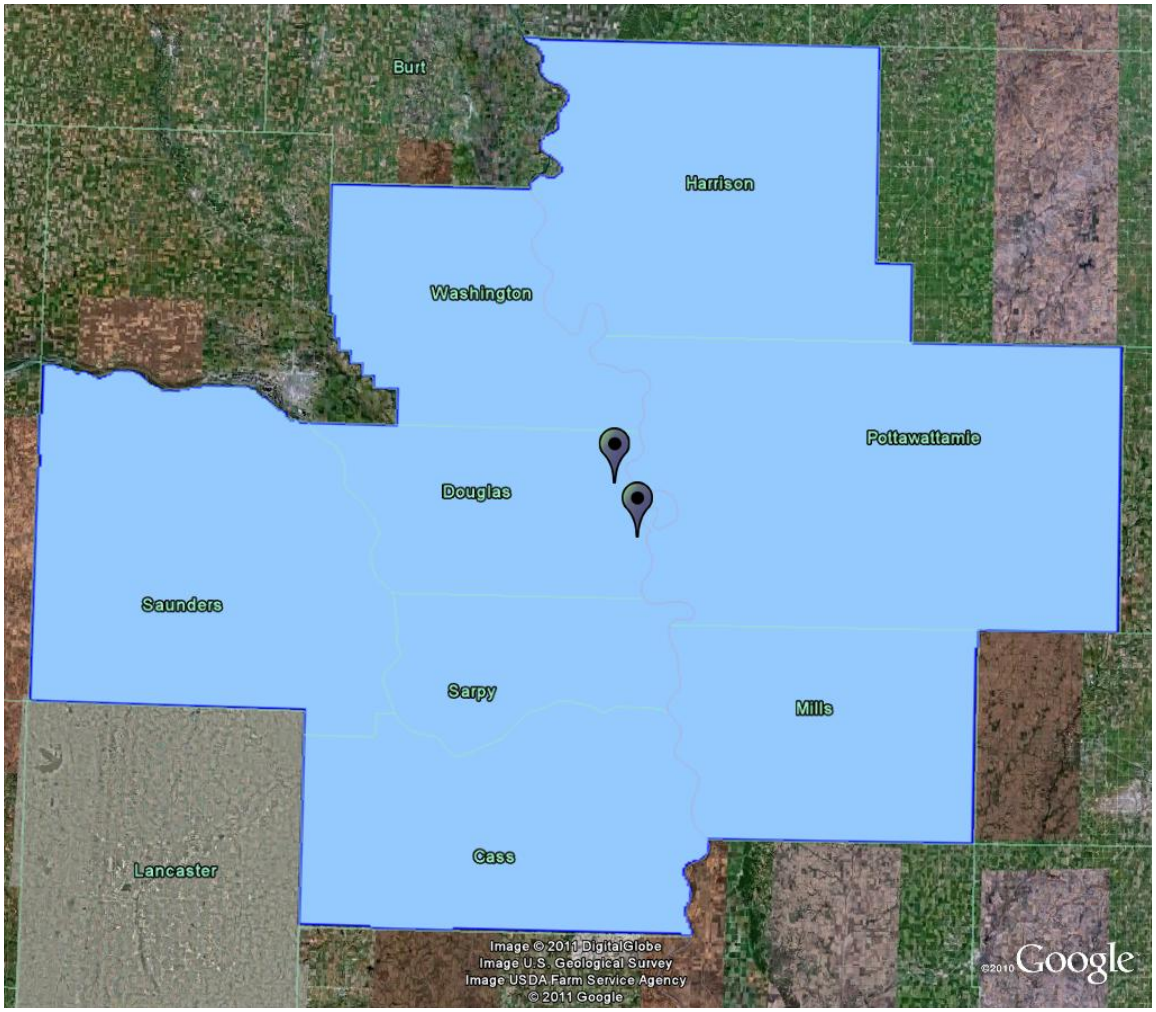
Iowa's SO_2 Monitoring Sites

Iowa's Woodbury County is included as a portion of the Sioux City, NE-IA-SD MSA. The following map shows the locations for all SLAMS SO_2 monitors that were operated in 2011 in the Sioux City MSA, including those operated by South Dakota, and Nebraska.



Sioux City, IA-NE-SD SO_2 SLAMS Monitors

Iowa's Harrison, Pottawattamie, and Mills Counties are included as a portion of the Omaha-Council Bluffs, NE-IA MSA. The following map shows the locations for all SLAMS SO_2 monitors that were operated in 2011 in the Omaha-Council Bluffs MSA, including those operated by Nebraska.



Omaha-Council Bluffs, NE-IA SO_2 SLAMS Monitors

Appendix I: Sioux City (MidAmerican George Neal Station) SO_2 Modeling

IOWA DEPARTMENT OF NATURAL RESOURCES
Environmental Services Division
Air Quality Bureau
Modeling Group

M E M O R A N D U M

DATE: **05/17/11**

TO:	**SEAN FITZSIMMONS**
FROM:	**LORI HANSON**
RE:	**EVALUATION OF POSSIBLE SO_2 MONITOR LOCATIONS IN VICINITY OF SIOUX CITY**
CC:	

ANALYSIS SUMMARY

Per request, a dispersion modeling analysis was conducted to evaluate possible SO_2 monitoring locations in the vicinity of Sioux City, Iowa. This modeling analysis evaluated SO_2 boiler emissions from MidAmerican Energy Company's George Neal North and George Neal South facilities for the new 1-hour SO_2 standard.

According to the results from the AMS/EPA Regulatory Model (AERMOD, dated 11103), the SO_2 emissions from the George Neal facilities will cause predicted concentrations that are greater than the applicable 1-hour SO_2 NAAQS.

An isopleth diagram indicating predicted 1-hour SO_2 concentrations, including background, is shown in Figure 1. The background value used for this evaluation is 7.86 $\mu g/m^3$ (3 ppb) and is based on the 1-hour design values calculated from Des Moines 2008 – 2010 monitoring data. The yellow isopleth represents 196 mg/m^3 (75 ppb), the new 1-hour NAAQS.

The boilers at the George Neal facilities were evaluated using the parameters listed in Table 1. The boilers were modeled using 2009 actual emission rates based on CEMs data as reported to the DNR by MidAmerican Energy Company.

Stack parameters are based on construction permits with the exception of the George Neal North boiler #3 and George Neal South boiler #4 temperature and flow rates. The temperature and flow rates for these boilers are based on current construction permit applications that have been submitted to the DNR (projects 11-155 and 10-658 respectively).

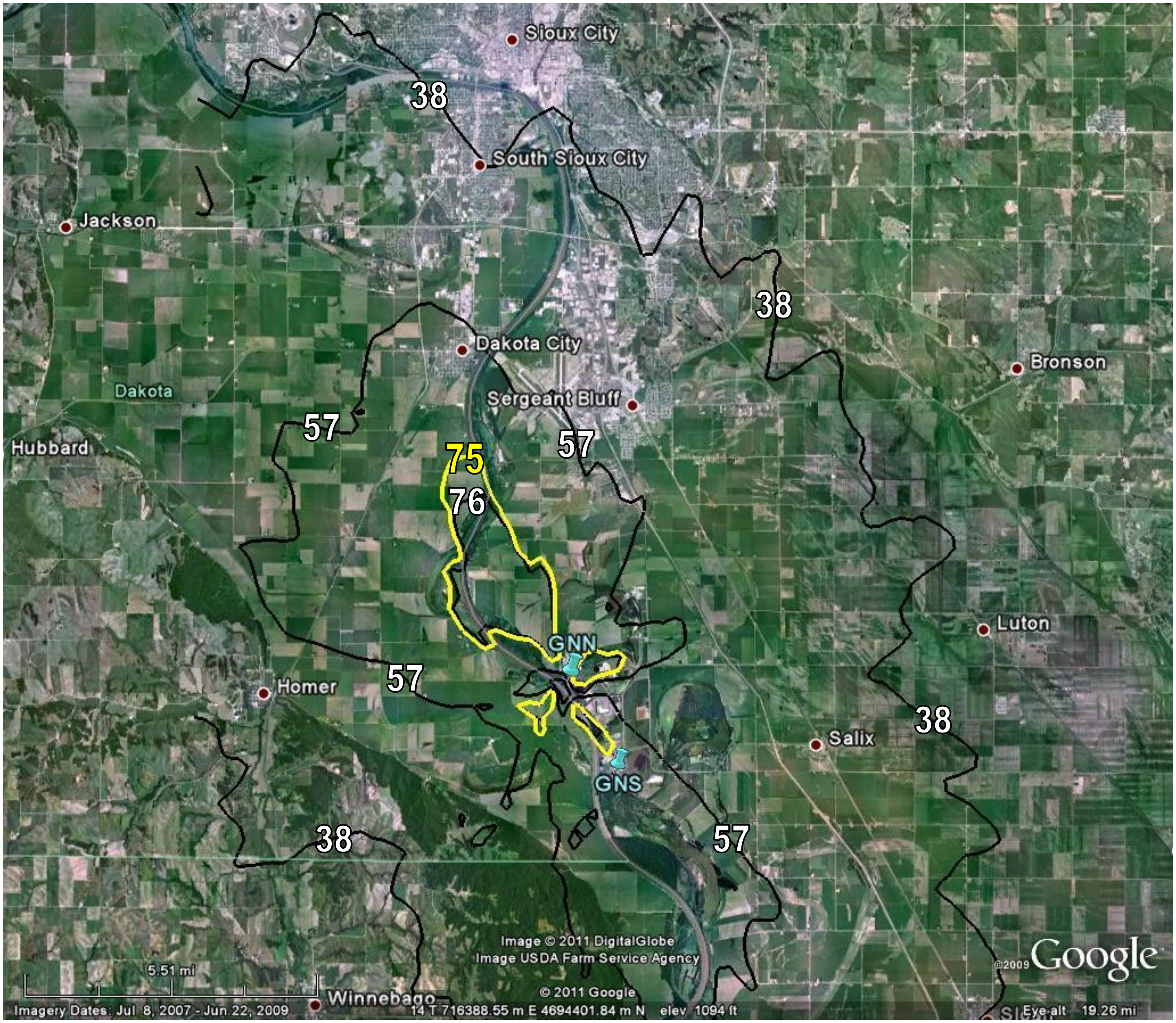
The worst-case 1-hour SO_2 modeling results are listed in Table 2. The boilers were modeled as operating 24 hours/day, 8760 hours/year.

Figure 1.

MidAmerican Energy George Neal Facilities

Dispersion Modeling Analysis of 2009 Actual Emissions

1-hour SO2, H4H with background of 3 ppb



Contour interval = 19 ppb
Yellow Contour = 75 ppb

Table 1. Modeled SO_2 Emission Rates and Stack Parameters – Point Sources

Emission Point	SO_2 (lb/hr)	Stack Height (ft)	Stack Gas Exit Temperature (°F)	Stack Tip Diameter (in)	Stack Gas Flow Rate (acfm)
GNN1	707.8	225	320	113	539,080
GNN2	1469.9	300	290	183	1,140,000
GNN3	2798.5	400	180	240	1,749,800
GNS4	2790.1	469	180	300	2,618,600

Table 2. Worst Case 1-hour SO_2 Modeling Results

Pollutant	Averaging Period	Predicted Concentration* ($\mu g/m^3$)	Background Concentration** ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
SO_2	1-hour	284.2 (109 ppb)	7.86 (3 ppb)	292.1 (112 ppb)	196 (75 ppb)

* The 1-hour concentrations are the highest-fourth-highest predicted values from all five years of meteorological data.

** The preliminary 1-hour SO_2 background concentration of 7.86 $\mu g/m^3$ (3 ppb) is based on Des Moines monitoring data from 2008-2010

Appendix J: Supplemental Sulfur Dioxide Modeling Analysis

Impact of Source Groups for the MidAmerican George Neal Power Station

MidAmerican's George Neal Power Station is located south of Sioux City on the Missouri River. There are two facilities comprising the station, George Neal North (GNN) and George Neal South (GNS). GNN is about 12 miles south of Sioux City and GNS is about 2 miles south of GNN. GNN and has three coal fired boilers: Unit 1 (120MW), Unit 2 (300MW) and Unit 3 (505 MW). (See Figure 1) GNS has one coal fired boiler, Unit 4 (644 MW). (See Figure 2) GNN Unit 1 is the oldest of the four units, has a shorter stack than the other boilers, and is located near the center of the GNN complex.

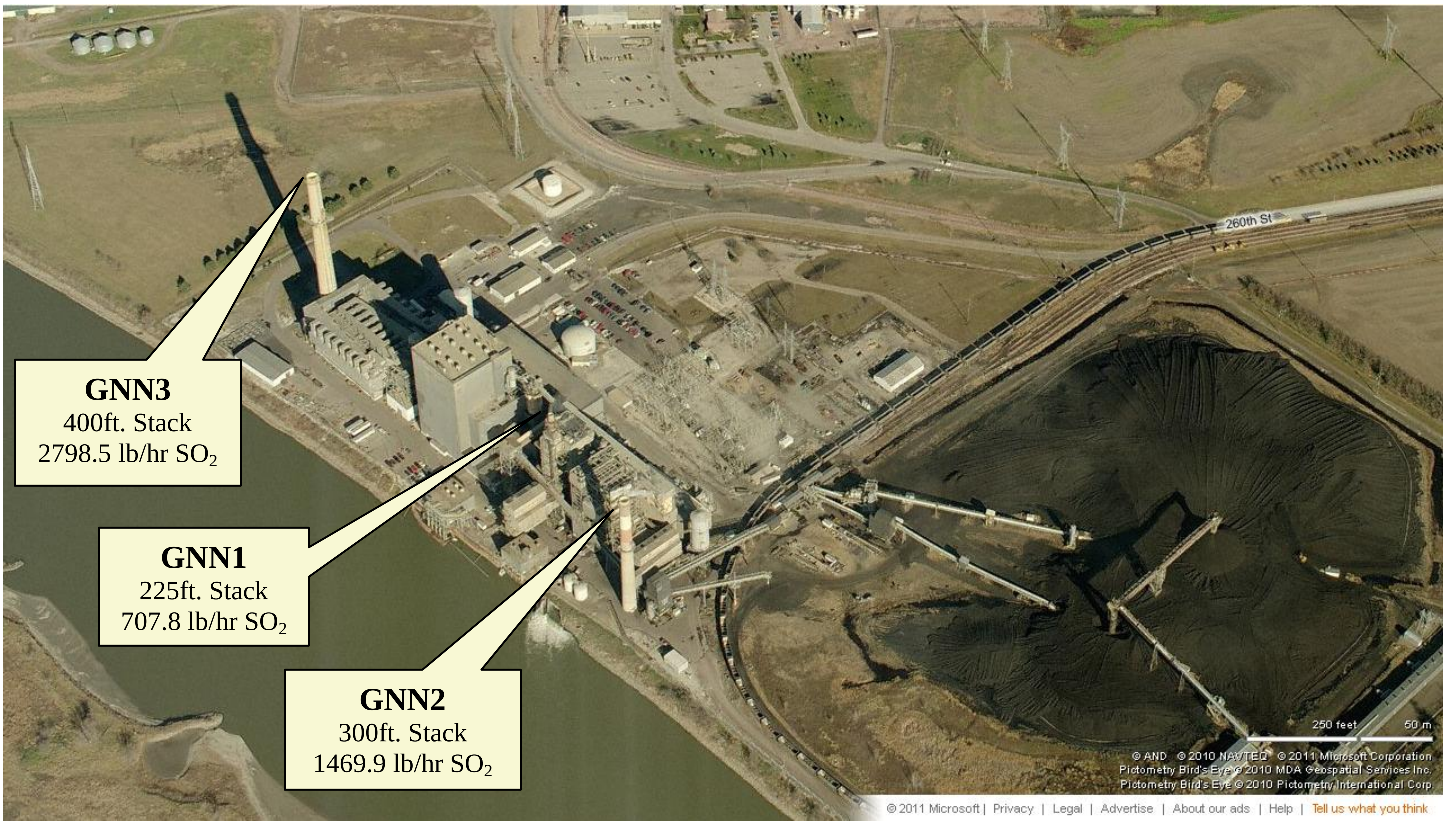


Figure 1. Relative location of SO_2 emission points for the MidAmerican George Neal North facility.

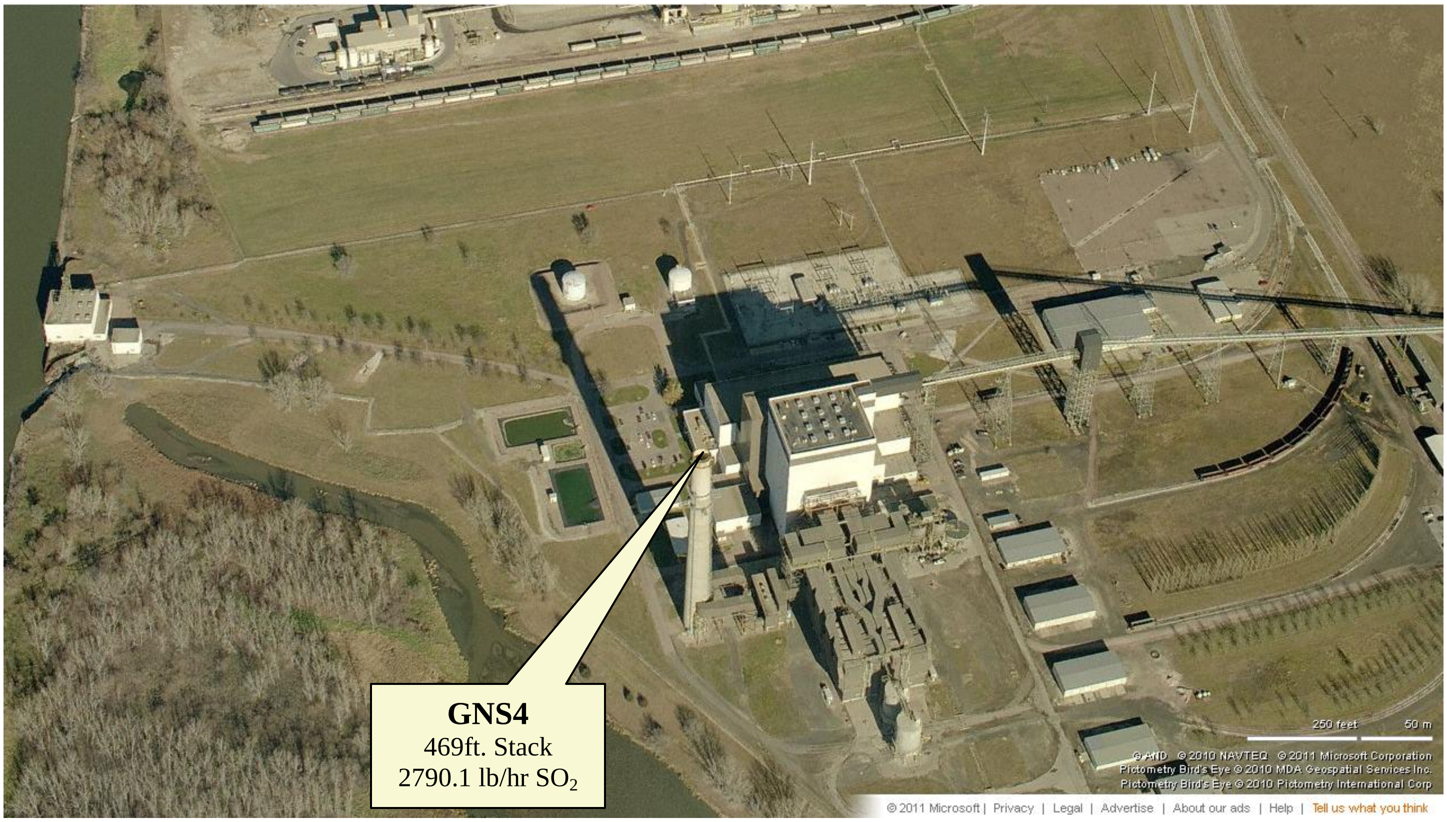


Figure 2. Relative location of SO_2 emission points for the MidAmerican George Neal South facility.

In order to facilitate monitor placement, the IDNR conducted dispersion modeling of the sulfur dioxide emissions from Neal Station. The modeling was performed using historical data; average emission rates were obtained from SO_2 monitors on the boiler stacks. The modeling indicates the areas that are predicted to exceed the NAAQS ("hotspots") are not in heavily populated areas. The largest hotspot lies in agricultural lands to the northwest of GNN, with smaller hotspots close to GNN to the northeast, southwest, and southeast. (See Figure 3 below and Appendix I)

Using a dispersion model, one can shut off the emissions from individual units. If one shuts off the emissions from Unit 1, the large hotspot to the northwest of GNN remains (Compare Figures 3 and 4 below). If one shuts off all units except Unit 1, the hotspots to the northeast and southwest of GNN remain as well as a tiny hotspot southeast of the facility (Compare Figures 3 and 5 below). It is well known that when the wind blows past an obstruction, a low pressure area (vacuum) is created downwind of the obstruction. This phenomenon is known by dispersion modelers as "downwash". The modeling of Neal Station shows that the plume from Unit 1 generates its highest impacts close to GNN, as the emissions from its short stack cannot escape the downwash from the buildings at GNN.

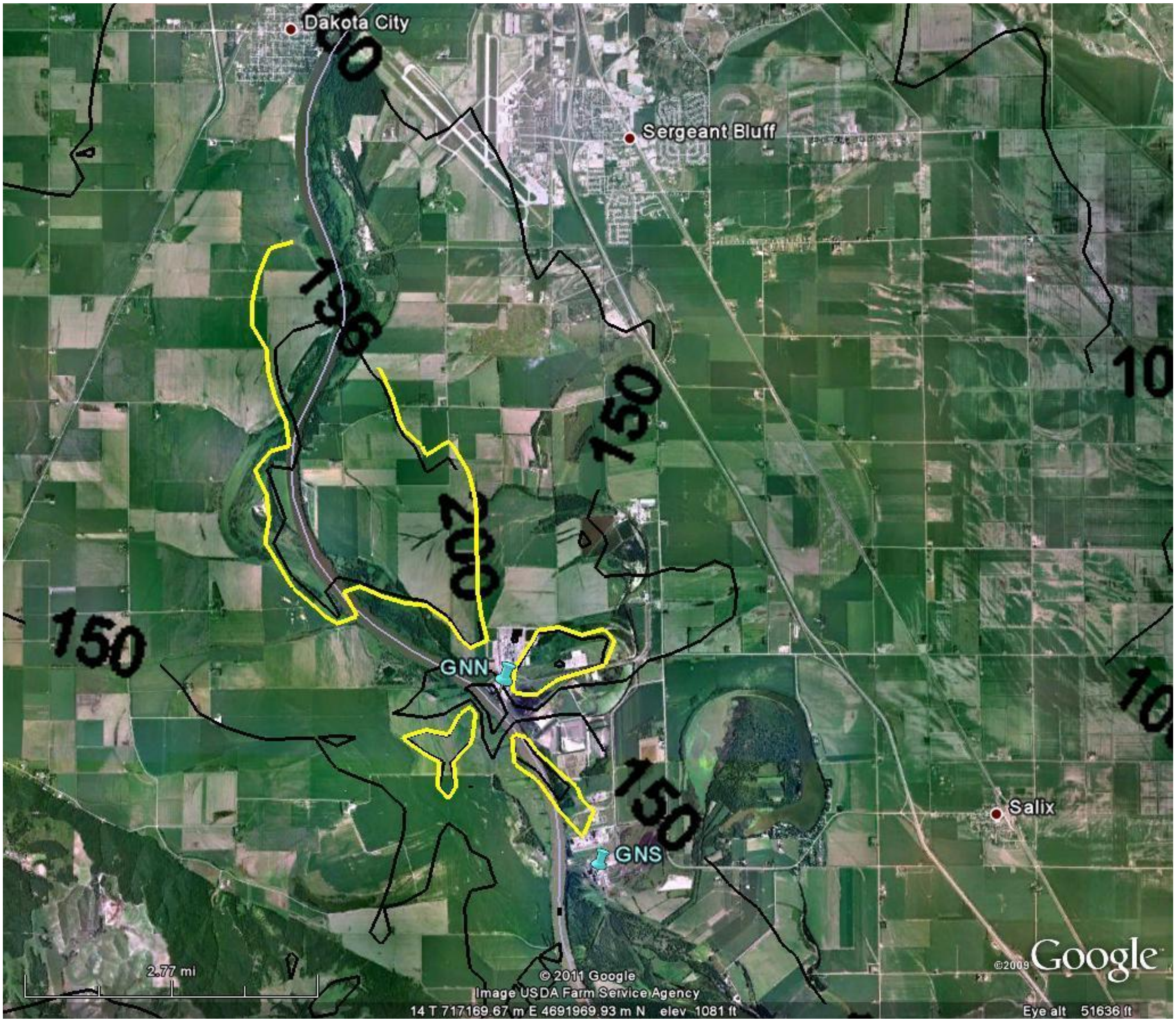


Figure 3. SO_2 Modeling of the MidAmerican George Neal facilities showing the impact of **ALL sources** (Units 1, 2, 3, and 4). Areas with predicted one-hour NAAQS violations are surrounded by yellow curves. Concentrations are expressed in $\mu g/m^3$; the NAAQS standard is 196 $\mu g/m^3$.

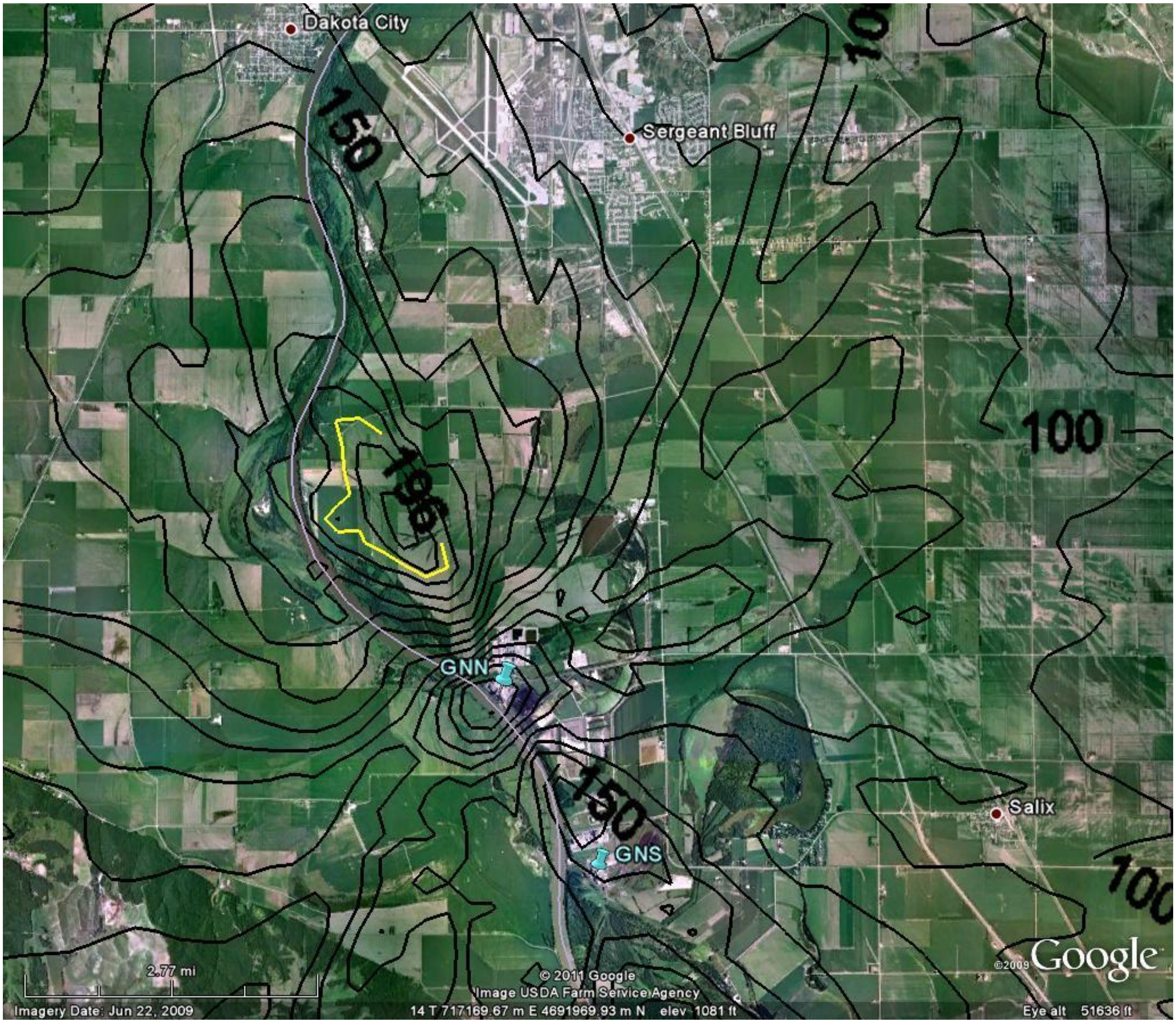


Figure 4. SO_2 Modeling of the MidAmerican George Neal facility showing the impact of **only Units 2, 3 and 4**. Areas with predicted one-hour NAAQS violations are surrounded by yellow curves. Concentrations are expressed in $\mu g/m^3$; the NAAQS standard is 196 $\mu g/m^3$.

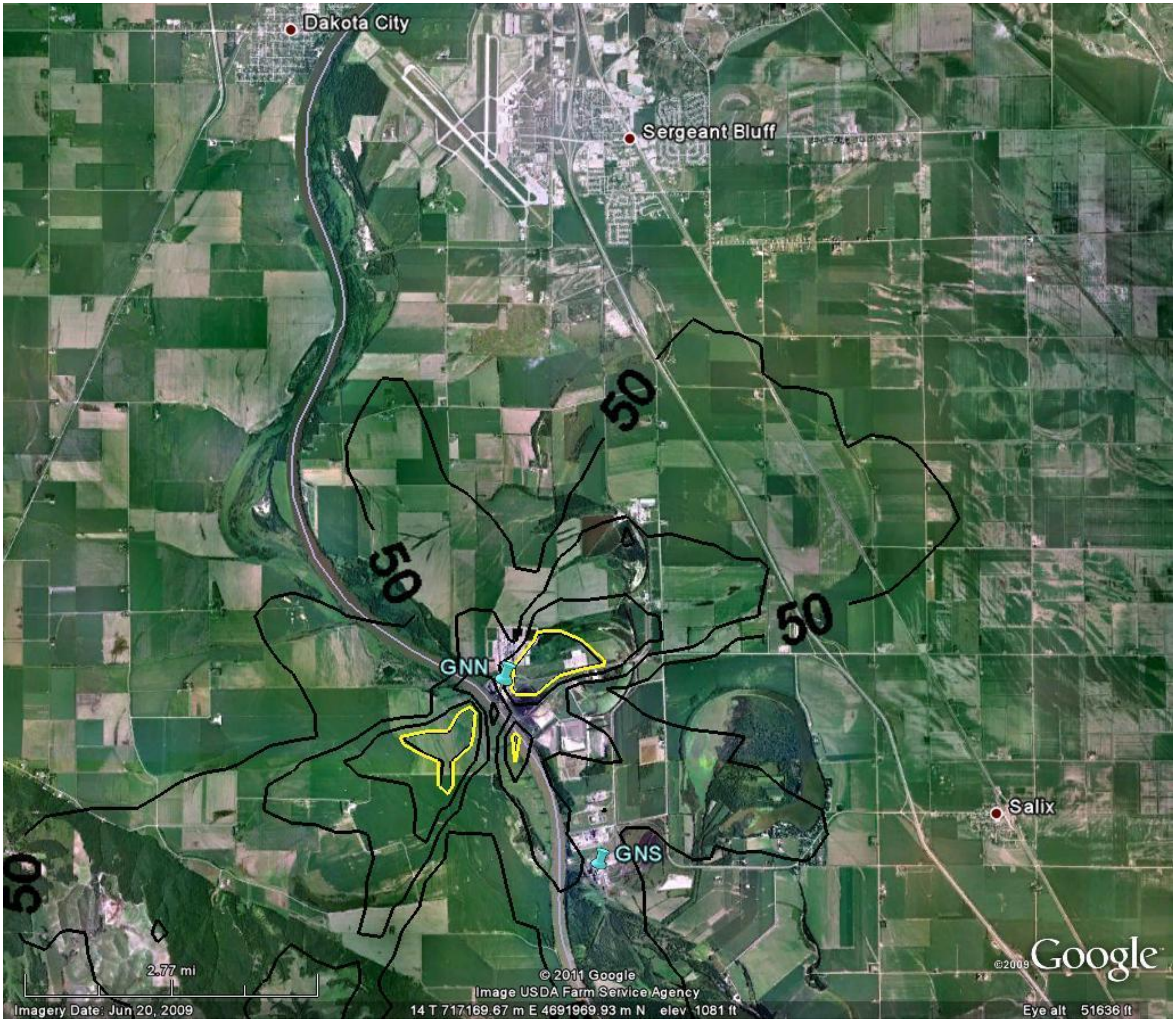


Figure 5. SO_2 Modeling of MidAmerican George Neal facility showing the impact of **only Unit 1**. Areas with predicted one-hour NAAQS violations are surrounded by yellow curves. Concentrations are expressed in $\mu g/m^3$; the NAAQS standard is 196 $\mu g/m^3$.

Flue gas desulfurization (FGD) is a pollution control technique that involves injection of a limestone slurry into the stack gas from a coal-fired boiler. FGD can reduce boiler SO_2 emissions by 85%, and is also effective in reducing emissions of other acid gases. EPA intends to regulate acid gases and mercury emissions with new "Utility MACT" regulations. EPA originally planned to finalize these regulations by November 16, 2011. However, EPA has recently announced it intends to reconsider certain elements of the rule[3].

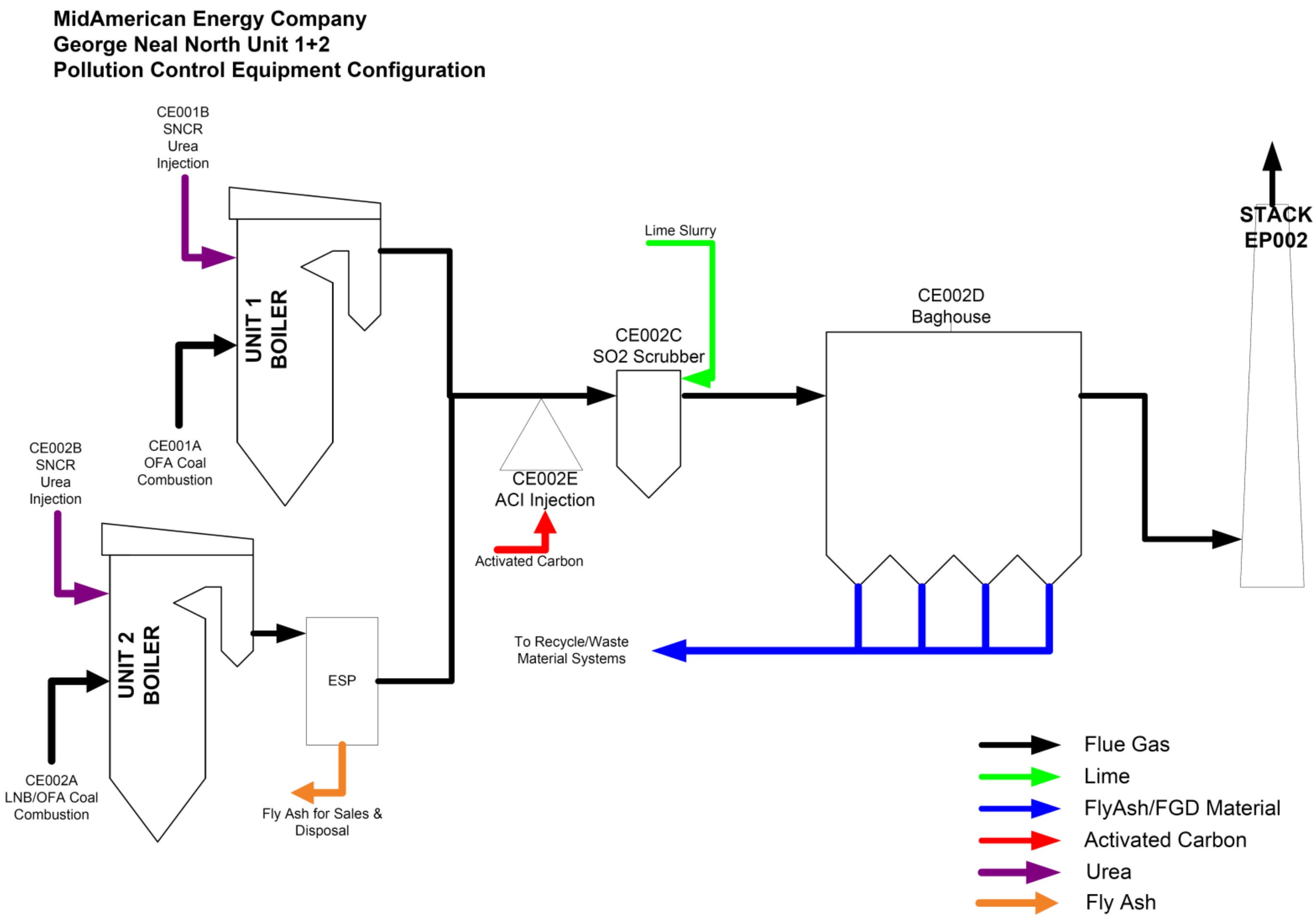
[3] More information on EPA's reconsideration of the Utility boiler MACT is available online at: http://www.epa.gov/ttn/atw/boiler/fr23de11major.pdf and http://www.epa.gov/ttn/atw/boiler/boilerpg.html

On May 16, 2011 the IDNR issued a construction permit to MidAmerican to install FGD at GNS Unit 4,[4] and on September 9, 2011 the IDNR a construction permit to MidAmerican to install FGD on GNN Unit 3.[5] These permits allow 42 months to complete construction of the FGD system.

Representatives of MidAmerican have requested a pre-application meeting to discuss a potential PSD[6] permit application that will affect the SO_2 impacts from Units 1 and 2. According to their proposal, emissions from Unit 1 will be combined with the emissions from Unit 2, run through the FGD control system and exhausted through the Unit 2 stack. More details on this project from the pre-application materials are indicated below:

Project Description

The proposed project will install selective non-catalytic reduction (SNCR) on Unit 1 and Unit 2 and a common control suite for the combined flue gas from the two units to include flue gas desulfurization (FGD), baghouse, and activated carbon injection (ACI).



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[4] https://aqbweb.iowadnr.gov/data/97/9704011/05-A-655-P1.pdf

[5] https://aqbweb.iowadnr.gov/data/97/9704010/95-A-313-P4.pdf

[6] Additional permits for MidAmerican George Neal Station's Units are available online at:
https://aqbweb.iowadnr.gov/data/97/9704010/05A878P.pdf
https://aqbweb.iowadnr.gov/data/97/9704010/07-A-951-P.pdf
https://aqbweb.iowadnr.gov/data/97/9704010/95-A-313-S2.pdf

Flue Gas Desulfurization (FGD)

Emissions of sulfur dioxide and other sulfur compounds will be controlled with the FGD system. The FGD system will consist of a lime spray dryer module and will have a SO2 removal efficiency of approximately 85 percent at the maximum coal sulfur content. Assuming maximum sulfur content of less than 1.3% by weight for all coals, the expected SO2 emissions will be approximately 0.4 lbs/mmBtu.

Project Schedule

Construction of the project is planned for September 2012, with installation occurring during the scheduled unit outage beginning in October 2014. The unit will be returned to service with the control systems commissioned in December 2014.

SO_2 emissions from Neal Station are expected to decline sharply as FGD is implemented on the four units. The department plans to perform additional dispersion modeling after the permits to install FGD on the last two units (Units 1 and 2) are finalized.